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| Author: Donald Hickmott                        |                       |                                    |   |

Environmental Restoration Project  
Standard Operating Procedure

for:

# Operational Guidelines for Taking Soil and Water Samples in Explosive Areas

## Los Alamos

NATIONAL LABORATORY

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Los Alamos, New Mexico 87545

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# Operational Guidelines for Taking Soil and Water Samples in Explosive Areas

## Table of Contents

|      |   |    |
|------|---|----|
| 1.0  | PURPOSE .....   | 4  |
| 2.0  | SCOPE.....  | 4  |
| 3.0  | TRAINING.....   | 4  |
| 4.0  | DEFINITIONS .....   | 5  |
| 5.0  | BACKGROUND AND PRECAUTIONS .....                                      | 6  |
| 6.0  | RESPONSIBLE PERSONNEL.....  | 8  |
| 7.0  | EQUIPMENT .....   | 9  |
| 8.0  | PROCEDURE .....   | 9  |
| 8.1  | <i>Plans, Pre-assessment, and Precautions</i> .....                   | 9  |
| 8.2  | Areas Generally Accepted as Free of HE Contamination.....             | 10 |
| 8.3  | Areas with Low-to-Negligible Probability of HE Contamination.....     | 10 |
| 8.4  | Areas with Potential HE Contamination .....                           | 10 |
| 8.5  | Areas with the Potential for Both HE and Radiation Contamination..... | 11 |
| 8.6  | Sample Collection Methods.....  | 11 |
| 8.7  | Transport of High HE Samples from the HE Corridor .....               | 12 |
| 8.8  | Perform Lessons Learned .....   | 12 |
| 9.0  | REFERENCES .....  | 12 |
| 10.0 | RECORDS.....  | 13 |
| 11.0 | ATTACHMENTS .....   | 13 |

# Operational Guidelines for Taking Soil and Water Samples in Explosive Areas

## 1.0 PURPOSE

This standard operating procedure (SOP) describes the operational guidelines for taking surface and subsurface soil samples and water samples in the high explosive (HE) corridor at the Los Alamos National Laboratory (the Laboratory) Environmental Restoration (ER) Project

## 2.0 SCOPE

- 2.1 This SOP is a mandatory document and shall be implemented by all ER Project participants when taking surface and subsurface soil samples and water samples in HE areas for the ER Project.
- 2.2 Subcontractors performing work under the ER Project's quality program shall follow this SOP for taking surface and subsurface soil samples and water samples in HE areas or may use their own procedure(s) as long as the substitute meets the requirements prescribed by the ER Project Quality Management Plan, and is approved by the ER Project's Quality Program Project Leader (QPPL) before the commencement of the designated activities.

## 3.0 TRAINING

- 3.1 ER Project personnel using this SOP are trained by reading the procedure, and the training is documented at <http://erinternal.lanl.gov/Training/Trainingmain.shtml> in accordance with ER quality procedure 2.2 (QP-2.2).
- 3.2 The **Field Team Leader** (FTL) shall monitor the proper implementation of this procedure and ensure that relevant team members have completed all applicable training assignments in accordance with QP-2.2.
- 3.3 Personnel entering the Laboratory's HE corridor to perform field operations must read the Site-Specific Health and Safety Plan (SSHASP), complete the HE Corridor Access Safety Course, and complete site-specific training at the host group. Enhanced off-road training may be required if work is conducted off pavement within the HE corridor.
- 3.4 It is the responsibility of the **FTL** to arrange and schedule the training, including training required by the host group. It is the responsibility of the host group to advise and participate in issuing the necessary security badges to uncleared visitors.

- 3.5 All personnel using the HE spot test kit (ER-SOP-10.06, R1, High Explosives Spot Test) must complete the DX-2 group's training course on the use of the kit. (DX-2 is the High Explosives Group at the Laboratory).

## 4.0 DEFINITIONS

- 4.1 Explosives — Energetic materials possessing a tremendous amount of potential energy that can be released instantaneously when acted upon by a stimulus. This can be a violent lethal reaction. At the Laboratory, operations with explosives are governed by a Laboratory Implementation Requirement (LIR): LIR 402-550-01.0, Explosives.
- 4.2 Field Team Leader (FTL) — An FTL is responsible for ensuring that all personnel taking samples in the HE corridor have been trained and that the host group with jurisdiction over the location of the sample collection has been informed of field operations. An FTL works directly with a Focus Area Team Leader to plan and execute fieldwork and to coordinate and supervise specific field operations.
- 4.3 Hazard circles — Areas in which hazards resulting from the firing of explosives or other explosive operations are likely to be present. Also called *hazard zones*.
- 4.4 HE representative — A site representative, assigned by the host group or the Facility Manager, who has oversight or assistance responsibilities for an ER field team.
- 4.5 HE spot test kit — A collection of chemical tests developed by DX-2 to detect explosives on surfaces. The nominal detection limit for the HE spot test kit is 100 ppm total HE. Use of the HE spot test kit is approved only for homogeneous-type samples and cannot be used reliably for heterogeneous samples.
- 4.6 Heterogeneous soil sample area — A heterogeneous soil sample area is one that contains randomly dispersed pieces of explosives that are not well mixed in a sample volume and that cannot be detected reliably using the HE spot test kit. The explosive pieces may be in large chunks or in small pieces; they may be on the surface or buried. These areas are potentially more hazardous than homogeneous areas. Examples of heterogeneous areas are the land surrounding the Technical Area 11 (TA-11) drop tower, the TA-14 firing sites, and the TA-67 (12) open firing pit. Determining whether a sampling area is heterogeneous or homogeneous is done by the host group. Samples that either test positive with the HE spot test kit or are collected from within a heterogeneous area must be submitted to DX-2 or to another host group HE-certified laboratory, including approved field laboratories, before being handled or treated further.

- 4.7 Homogeneous soil sample area— A homogeneous soil sample area is one that contains high-solubility explosive materials that are well dispersed within the desired sample volume such that the explosives can be detected reliably by the HE spot test kit. All homogeneous samples testing positive for HE using the spot test kit must be further analyzed by DX-2 or by another host group HE-certified laboratory, including field laboratories. Transport of the samples to DX-2 or to another laboratory approved by the host group must be done as specified in the work plan or SSHASP. If quantitative HE analysis determines that the total explosive content of a homogeneous sample is >5%, the sample must be handled and transported as an explosive. If the quantitative analysis determines that the total explosive content is <5%, the sample can be shipped as a non-explosive environmental sample.
- 4.8 Host group— The operating group for the technical area in which explosives-bearing samples will be collected. At the time of this writing, DX groups are the host groups for TA-6, -7, -8, -9, -14, -15, -22, -36, -39, -40, -60, -67, and -69, and Engineering Sciences and Applications (ESA) groups are the host groups for TA-11, -16, -28, and -37.
- 4.9 Off-site— Locations outside the control of the host group and possibly outside the HE corridor. Off-site transport usually involves the use of public roads.
- 4.10 Radiation control technician (RCT)— A person trained in radiation theory and in the use of radiation detection equipment.
- 4.11 Site-Specific Health and Safety Plan (SSHASP)— A health and safety plan that is specific to a site or ER-related field activity and has been approved by an ER Project health and safety representative. A SSHASP contains information specific to the project, including scope of work, relevant history, descriptions of hazards (by activity) associated with the project site, and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

## 5.0 BACKGROUND AND PRECAUTIONS

**Note:** This SOP shall be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

### 5.1 Background

Since the mid-1940s, explosives development, processing, and testing operations have been performed at several TAs at the Laboratory. Explosives handling and operations are subject to much more stringent safety requirements than most other chemical process operations because of the inherently hazardous behavior of explosive compounds. During the many years of explosives development, explosives and devices containing

explosives may have been scattered or deposited both inside and outside of the hazard circles. Also, during the mid-1940s, depleted uranium, other radionuclides, and energetic materials were used in the research, development, and testing of weapon's components in the HE corridor. Therefore, extreme caution is required for all field operations in the areas where there are or were explosives operations.

## 5.2 Facility Management

- 5.1.1 Before work commences, all plans, including sampling, drilling, waste-management, and SSHASPs must be in place; all permits must be obtained; all access requirements must be arranged; and all training requirements must be met.
- 5.1.2 Contact the appropriate host groups for a review of all the proposed work and to complete the application for a facility work request per LIR 230-03-01.5, Facility Management Work Control.

## 5.3 Hazards

- 5.3.1 High-energy explosives, and components containing high-energy explosives, can be found in many colors and forms in which their presence may not be obvious. Some hazards are as follows:
  - Striking high-level HE soil with metal objects or other hard surface items.
  - Screwing crystals of explosives between the lid and the lip of sample glass bottle.
  - Handling pieces and chunks of weathered explosives.
  - Detonating HE components or pieces—handle with care.
  - Impacts, pinch points, heat, sparks, and flames all have the potential to initiate explosives.

## 5.4 Precautions

- 5.4.1 Weathered explosives and explosives exposed to other substances are potentially sensitive. Strict guidelines have been established for taking and handling samples potentially contaminated with HE; for collection and removal of items, devices, or components of weapons assembly; and for transporting hazardous samples. The following requirements are enforced.
- 5.4.2 Whenever possible, the tools used to take the sample must be aluminum, plastic, or other host group-approved material which will not produce a spark when struck against rocks, concrete, or metallic objects. The host group may choose to authorize tools not covered by their SOPs to facilitate this work.

- 5.4.3 Containers used to store HE-contaminated samples shall be made of glass or non-leachable plastic with a Teflon-coated plastic lid or host group–approved alternative.
- 5.4.4 Utility trailers and portable laboratories are often used in fieldwork. Although heat sources, open flames, and spark-producing devices are prohibited in the HE corridor (they have the potential of initiating explosives), a special permit can be obtained from the host group when such devices are needed for sampling and analyses within contaminated areas.
- 5.4.5 Chunks of explosives and any components, materials, or objects found during sampling must not be handled or removed unless they are to be analyzed as part of the sample. If the object or component is an explosive, detonator, or component containing explosives, the sensitivity may be increased due to exposure to the weather or by being mixed with unknown materials at the location. The HE representative assigned to your field team should look at the materials, and the RCT or radiological screening personnel should scan them before they are transferred from the field. Unauthorized removal of any material from the sites is not allowed.
- 5.4.6 Any amount of explosive in a soil sample can represent a safety hazard. However, soil samples with up to 5% explosives, as determined by host group–approved quantitative analysis, may be removed from the corridor as non-HE environmental samples.
- 5.4.7 Authorized personnel from the host group or division must give written approval for the removal of samples containing more than 5% HE from the HE corridor. DOT shipping requirements must also be followed. The host group must be consulted when preparing explosives shipments. A laboratory capable of housing and analyzing >5% HE must be used. Such samples will rarely be encountered.

## 5.5 Radiation Exposure

Dosimeter badges must be worn by personnel in areas suspected of being contaminated with radiation. An RCT or health physics monitor must scan personnel, equipment, vehicles, and supplies before they leave an area known to be contaminated with radiation. Further requirements for work in areas of potential radiation exposure are outlined in the SSHASP.

## 6.0 RESPONSIBLE PERSONNEL

- 6.1 ER Project Personnel
- 6.2 Field Team Leader



- 6.3 Field Team Members
- 6.4 Focus Area Leader
- 6.5 Quality Program Project Leader
- 6.6 Subcontractors

## 7.0 EQUIPMENT

The equipment required for this procedure is that which is specified in the site-specific sampling and analysis plan and in the SOPs guiding sample collection.

## 8.0 PROCEDURE

**Note:** ER Project personnel may produce paper copies of this procedure printed from the controlled-document electronic file located at [http://erinternal.lanl.gov/home\\_links/Library\\_proc.shtml](http://erinternal.lanl.gov/home_links/Library_proc.shtml). However, it is each person's responsibility to ensure that they trained to and utilize the current version of this procedure. The author may be contacted if text is unclear. The Document Control Coordinator (DCC) may be contacted if the author cannot be located.

**Note:** Deviations from SOPs shall be made in accordance with QP-4.2, Standard Operating Procedure Development, and documented in accordance with QP-5.7, Notebook Documentation for Environmental Restoration Technical Activities.

### 8.1 Plans, Pre-assessment, and Precautions

The following actions steps must be followed to collect, analyze, and approve off-site release of collected samples:

- 8.1.1 Either the sampling plan, or a summary of the sampling plan, must be made available to the facility manager and it must include the sample locations, types of sampling (surface, subsurface, or water), depth of sampling (if sampling is subsurface), quantity of samples, and analytes.
- 8.1.2 If subsurface sampling is requested, a detailed description of the method and type of equipment that will be used to extract the samples is required.
- 8.1.3 The **FTL** interacts with the authorized host group personnel upon approval of the sampling plan. The **FTL** is responsible for obtaining any special work permits for equipment, prior to beginning the sampling event.

- 8.1.4 The soil samples belong to one of four categories: (1) explosives-free areas with no probability of HE contamination, (2) low-to-negligible probability of HE contamination, (3) areas with potential for HE contamination, and (4) areas with the potential for both HE and radioactive contamination. Areas that potentially contain HE are further classified as homogeneous or heterogeneous (see section 4.0 for definitions).

## **8.2 Areas Generally Accepted as Free of HE Contamination**

When samples are taken from explosives-free areas, they must be packaged and labeled appropriately. If no other hazardous substances are present, they can be transported as non-hazardous materials.

## **8.3 Areas with Low-to-Negligible Probability of HE Contamination**

- 8.3.1 Some locations are not known to have been exposed to explosives; however, HE contamination remains a remote possibility in the explosives corridor. A visual examination as well as the HE spot test kit, D TECH kit, EnSys kit, or other host group-approved field analytical method can be used on homogeneous or heterogeneous soil mixtures to make an initial characterization.
- 8.3.2 A visual examination by the HE representative at these areas can rule out the possibility of heterogeneous-type contamination. Negative results from the HE spot test kit or other field test kits rule out the possibility of homogeneous contamination. Negative results from both the visual examination and the spot test may allow the samples to be released off-site.
- 8.3.3 If the visual examination shows HE material or if any of the HE spot tests are positive, the location must be considered an HE-contaminated area. The visual examination, HE spot test kit, and field test kit still leave a margin of error when attempting to detect HE in soil.
- 8.3.4 When samples are taken from explosives-free areas, they must be packaged and labeled appropriately. If no other hazardous substances are present, they can be transported as non-hazardous materials.

## **8.4 Areas with Potential HE Contamination**

- 8.4.1 Some locations have a high probability of HE contamination, whether homogeneous or heterogeneous in nature. These locations include firing mounds, stream beds and/or drainages from sites with known contamination, and outfalls from HE-processing facilities.

- 8.4.2 The required SOPs, policies, and safety devices (e.g., shields, machine guards, remote setup, and PPE) must be in place. Also, HE cannot be concentrated once removed from the solid or water; (i.e., do not combine 5 g samples to make a 25 g sample for easy storage). These samples may be transported as either non-hazardous or explosive samples, depending upon the designation of the sampling location as heterogeneous or homogeneous and on the results of the HE spot test and subsequent quantitative analysis.

## **8.5 Areas with the Potential for Both HE and Radiation Contamination**

- 8.5.1 Because radionuclides were used in some areas of the HE corridor, it is possible that soil could be contaminated with both HE and radiation. Samples that are greater than 5% HE and radioactive will require special packaging and labeling before they can be removed from the sample site. The host group will provide this service. Also, a laboratory capable of analyzing such samples must be used.
- 8.5.2 At areas known to be contaminated with both HE and radiation, a health physics monitor, RCT, or radiological screening personnel must be present for sampling.

## **8.6 Sample Collection Methods**

- 8.6.1 To collect soil samples, follow the method outlined in ER-SOP-6.09, Spade-and-Scoop Method for the Collection of Soil Samples.
- 8.6.2 For pure explosives or explosive components, call the HE representative assigned to your team to arrange for host group personnel to collect, package, label, and transport the sample. Follow ER-SOP-6.13, Surface Water Sampling, and/or ER-SOP-10.06, High Explosives Spot Test, when necessary.
- 8.6.3 ER-SOP-4.01, Drilling Methods and Drill Site Management, and ER-SOP-4.04, Contract Geophysical Logging, are to be followed during drilling operations in the HE corridor. Remote drilling may be required at some locations where significant amounts of subsurface contamination are possible.
- 8.6.4 An authorized HE representative from the host group must be present during the pre-assessment and on call during sample collection. Whenever possible, tools used to take the sample must be aluminum, plastic, or other approved material that will not produce a spark when struck against rocks, concrete, or metallic objects.
- 8.6.5 Equipment and methods required for subsurface sampling will be reviewed on an individual basis in the same manner that excavation and trenching work by contractors in the HE corridor is reviewed. The

FTL will coordinate equipment reviews with the host group and ensure that appropriate special work permits are obtained.

## **8.7 Transport of High HE Samples from the HE Corridor**

8.7.1 If the results of the HE spot test kit are positive, or if a sample is from a heterogeneous area and off-site shipping will be conducted. The HE representative must be called to:

- arrange packaging, labeling, and transportation of the sample to DX-2 or a host group–approved laboratory for analysis, or
- contact the shipping representative at S-Site (7-6792) for help with off-site shipping.

8.7.2 Be sure to follow existing Laboratory guidelines and any additional hazardous material shipment requirements specified by the specific location or host group. Off-site transportation of HE samples must follow DOT regulations.

## **8.8 Perform Lessons Learned**

During the performance of work, **ER Project personnel** shall identify, document, and submit lessons learned, as appropriate in accordance with QP-3.2, Lessons Learned, located at [http://erinternal.lanl.gov/home\\_links/Library\\_proc.shtml](http://erinternal.lanl.gov/home_links/Library_proc.shtml).

## **9.0 REFERENCES**

ER Project personnel using this procedure should become familiar with the contents of the following documents to properly implement this SOP.

**Note:** The Quality Management Plan and the QPs can be found at [http://erinternal.lanl.gov/home\\_links/Library\\_proc.shtml](http://erinternal.lanl.gov/home_links/Library_proc.shtml).

- QP-2.2, Personnel Orientation and Training
- QP-3.2, Lessons Learned
- QP-4.2, Standard Operating Procedure Development
- QP-4.4, Record Transmittal to the Records Processing Facility
- QP-5.7, Notebook Documentation for Environmental Restoration Technical Activities
- ER-SOP-1.04, Sample Control and Field Documentation
- ER-SOP-1.06, Management of Environmental Restoration Project Wastes
- ER-SOP-1.08, Field Decontamination of Drilling and Sampling Equipment
- ER-SOP-4.01, Drilling Methods and Drill Site Management

- ER-SOP-4.04, Contract Geophysical Logging
- ER-SOP-6.09, Spade-and-Scoop Method for the Collection of Soil Samples
- ER-SOP-6.13, Surface Water Sampling
- ER-SOP-10.06, High Explosives Spot Test
- LIR 230-03-01.5, Facility Management Work Control
- LIR 402-550-01.0, Explosives
- DX-SOP, Environmental Work in FMU-67

## **10.0 RECORDS**

The **FTL** is responsible for submitting the following records (processed in accordance with QP-4.4, Record Transmittal to the Records Processing Facility) to the Records Processing Facility.

- 10.1 Chain-of-Custody Forms/Request-for-Analysis Forms
- 10.2 Field notebooks or daily activity logs
- 10.3 Sample collection logs
- 10.4 Completed Document Signature Forms
- 10.5 All associated correspondence

## **11.0 ATTACHMENTS**

Attachment A: Map of TAs in Which Explosives Research, Development, and Testing Have Occurred at the Laboratory (1 page)

